The linkage between bank net interest margins and non-interest income : The case of the Cambodian Banking industry

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This research paper studies the relationship between bank net interest margin (NIM) and non-interest income (NII) using Cambodian banking data. The research focuses on the contribution of the NII, which is the non-traditional banking activity, to the banking profitability. The analysis runs a three-stage least square system to handle the NIM and NII employing 28 banks data from 2004-2010. For the growing period, there is a trade-off between interest margin and non-interest income. It is argued that banks increase non-traditional activities associates with the reduction in net interest margin and vice-versa. This paper also finds that the non-traditional activities have positive causal effect on net interest margin in the post financial crisis period.

Keywords: Bank interest margin, non-interest income, Cambodian banking, bank risk

1. INTRODUCTION

The innovation of the financial system has changed the banks' products and has increased the banks' activities. The banks' profit has generated from both interest income and non-interest income in term of traditional and nontraditional activities. In the global context, the arising of banks and financial institutions has increased the competition even though there are many regulations exist. There have been observed that non-interest income becomes more important while the banks start focusing on the non-traditional activities. One of the important implications refers to the bank profit which generated from interest income and non-interest income. It is believed that both interest and non-interest incomes have endogenous relationship and cause some issues to the financial authorities in term of banking profitability and financial sustainability. Further, bank profitability is considered as a big issue in the view of microprudential framework. In the microprudential, the bottom-up approach has been used to ensure each bank is safe and sound.

Exploring the banking system development in Cambodia, the increasing numbers of banks within the last decade raise many concerns of the policy makers. The profit of the banks is one of the authorities' concerns related to financial stability. In this case, the arising of non-interest income in the Cambodian banking system can tell us that Cambodian banks now start to diversify their products to generate more income while we can observe that there might be increasing the demand of the nontraditional services. Hence, the key ideas come up with 2 main indicators: interest income and non-interest income. Defining non-interest income, our study refers to the income that generates from nontraditional activities. However, the interest income is specified as traditional activities since income from interest rates has been common for all banks. Given this context, the research problems appear with the questions how the non-interest income related to interest income and whether both indicators interact with each other in the context of Cambodian banking. Based on some previous researches in other countries, this study can extract some important key literature reviews and applies to the case of Cambodia.

This research's interest has addressed the above problems focusing on the causal effect of non-interest income and bank margin by reviewing some previous and the recent studies that conduct research on diversification and its nature in Europe and develop countries that have discussed over time about this issue and policies. In the majority studies that examine the bank income diversification, the aggregate level of the non-interest income increases overtimes and becomes

important; especially, the bank product diversification has correlation with interest income. Many studies have observed this movement from the competition and evolution of financial markets. Most of previous researches about non-interest income share the similar interest about market evolution, which draw their attention to conduct research. Busch & Kick (2009), who studied the income diversity in Germany banking from 1995 to 2007, explained the cross-subsidization effect of interest income and fee-based service, and they examined the non-interest income affected the interest margin. Another research, Davis (2002) employed a study of cross-countries using 28 OECD countries for 1979-1995. He investigated the financial behavior and focused on the structure of interest and non-interest income. He finds that non-interest income rises along with the increase of banking competition. Supporting the profit diversification, Demsetz & Strahan (1997) point out that diversify source of profit will reduce the uncertainty of failure. The evident from USA, Rogers & Sinkey Jr. (1999) have analyzed the nontraditional activities at U.S. commercial banks. Their research panel data of 8931 banks in United State from 1989 through 1993, which uses the fixed and random effect, has found that nontraditional activities have negative relationships with traditional activities. Stiroh (2002) also finds that non-interest income has correlation with interest income, and non-interest income is volatile. In addition, Williams & Rajaguru (2009), who study the Australian banks using the panel vector autoregressions model, have found that non-interest income has increased to substitute the reduction in the interest income level. Nguyen (2012) has researched about the relationship between net interest margin and non-interest income using a system estimation approach for 28 financially liberalized countries during 1997 and 2002. He found that the bank margin has a negative relationship with non-interest income and suggesting that there is no diversification benefit. In brief, the nature of bank interest margin and non-interest income has a different perspective among different countries; it might be because of the different situation and economy in each country.

Following from many previous studies which has reviewed above, our study has investigated the linkage between non-interest income and bank margin in order to capture the bank profit structure in Cambodia. This study uses panel data employing the three-stage least square approaches by eliminating the endogeneity problem in the model over the period 2004 to 2010. Our model conducts jointly two equations as a simultaneous system using the three-stage least square with two different periods covering 25 banks. This research model has divided the whole sample into two sample periods in order to find the difference between growing period and less-growing period following the situation of the Cambodian economy. However, we also use time

dummy to eliminate time effect; thus, we can see both different result. Interestingly, both results share the same sign coefficients, but most significant results appear when we use time dummy. This analysis also examines some behaviors and the natures of these two activities. Banks size and bank's risk have been included in the models follows many previous researches to capture the nature and to find the major differences among these two indicators. Since our research has focused on non-interest income which shares from non-traditional activities, our models use share of non-interest income which represents the nontraditional activities. Further, our analysis contains two equations. First equation refers to the determinant of bank margin and the second equation refers to the determinant of non-interest income.

The result of our paper showing only the qualitative outcome even though we use the econometric model because we focus on the sign and the relationship ignoring the real number of the variable coefficient. The main outcomes of the regression show that the bank net interest margin and non-interest incomes have the significant negative effect on each other in the first period result, but the second period result show that the only non-interest income has positive effect on bank net interest margin. These phenomena reflect the changing of banking profit structure diversification, and its nature is changing over the situation such that growing and less-growing period. By the way, there are some components which differentiate the nature of interest and non-interest income.

The rest of the paper constructs as follow. Section 2 provides the development of the Cambodian banking system. It describes the information and some changing in the Cambodian financial system in the past and present. Section 3 describes the data and the empirical econometric methodology. In this section, we also discuss the results and the relationship between interest and non-interest income related to policies. Section 4 presents the concluding remarks and policy recommendations.

2. EMPIRICAL ANALYSIS

Traditional banking activities mainly consist of receiving deposits and granting loans. Recent trend of product diversification of the banking services under financial deregulation implies that banks have been encouraged to involve non-traditional banking activities, such as cash management, bank account management, and other off-balance sheet services. This section

empirically examines how traditional banking and non-traditional banking activities are mutually related in the Cambodian banking industry. The understanding of the relationship between the two classes of these activities would provide important implications for monetary authority which has the responsibility to design sound financial regulation.

3.1 Methodology

Table 1 reports the numbers of commercial and specialized banks in the Cambodian banking system during the period from the last quarter of 2004 to the second quarter of 2010. During the period, the number of banks increased from 17 in 2004 to 33 in 2010 with 3 closed banks and 19 new entries. Due to the data availability, our unbalanced panel data on a quarterly base covers 28 banks from the last quarter of 2004 to the second quarter of 2010, totaling 418 observations available for our analysis (see Table 2).[1] All the bank-level data of income statements and balance sheets is taken from the NBC.

Table 1 : Summary of Banks in the Cambodian Banking System

Date	Total[2] Bank	Commercials Bank	Specialized Bank	Closed Banks	New[3] Banks Entry
2004:Q4	17	14	3	0	0
2005:Q1	17	14	3	0	0
2005:Q2	17	14	3	0	0
2005:Q3	18	15	3	0	1
2005:Q4	18	15	3	0	0
2006:Q1	19	15	4	0	1
2006:Q2	19	15	4	0	0

[1] Due to the data unavailability, our panel data includes 30 banks, and those are: Cambodian Commercial Bank, Canadia Bank, Cambodian Public Bank, May Bank, Krung Thai Bank, Vattanac Bank, Cambodia Asia Bank, Singapore Banking Corporation, Foreign Trade Bank, Cambodia Mekong Bank, Union Commercial Bank, Maruhan Japan Bank, Advance Bank of Asia, First Commercial Bank, Rural Development Bank, ACLEDA Bank, Peng Heng Specialized Bank, ANZ Royal Bank, First Investment Specialized Bank, Anco Specialized Bank, Camko Bank, Bank for Investment and Development of Cambodia, Shinhan Khmer Bank, Kookmin Bank Cambodia, Booyung Khmer Bank, Phnom Penh Commercial Bank, OSK Indochina Bank, Angkor Capital Specialized Bank, SACOM Bank, Bank of India Phnom Penh Branch

[2] Total numbers of all banks in the banking systems
[3] Refer to the new banks entry during the period.

2006:Q3	20	15	5	0	1
2006:Q4	20	15	5	0	0
2007:Q1	20	15	5	0	0
2007:Q2	21	16	5	0	1
2007:Q3	23	17	6	0	2
2007:Q4	24	18	6	0	1
2008:Q1	24	18	6	0	0
2008:Q2	25	19	6	1	2
2008:Q3	29	22	7	1	5
2008:Q4	30	23	7	0	1
2009:Q1	30	23	7	0	0
2009:Q2	32	25	7	0	2
2009:Q3	33	26	7	0	1
2009:Q4	33	26	7	0	0
2010:Q1	33	26	7	1	1
2010:Q2	33	26	7	0	0
Total	555	432	123	3	19

Table 2 : Summary of banks in the model

Date	Bank in the Model[4]	Commercials Bank	Specialized Bank
First Period	165	136	29
2004:Q4	0	0	0
2005:Q1	16	13	3
2005:Q2	16	12	4
2005:Q3	16	13	3
2005:Q4	16	13	3
2006:Q1	16	13	3
2006:Q2	17	14	3
2006:Q3	17	15	2
2006:Q4	17	14	3
2007:Q1	17	14	3

[4] Refer total banks that the model regression captures. Because data set has some missing value.

2007:Q2	17	15	2
Second Period	253	203	50
2007:Q3	18	15	3
2007:Q4	17	13	4
2008:Q1	18	15	3
2008:Q2	19	15	4
2008:Q3	18	14	4
2008:Q4	18	13	5
2009:Q1	20	18	2
2009:Q2	21	16	5
2009:Q3	24	20	4
2009:Q4	24	19	5
2010:Q1	28	22	6
2010:Q2	28	23	5
Total	418	339	79

To discuss the relationship between traditional and non-traditional banking activities, we estimate the simultaneous equations, following the methodology of Nguyen (2012):

$$NIM_{it} = \alpha_0 + \alpha_1 NII_{it} + \sum_k \gamma_{kit} X_{kit} + u_{it}\,, \quad (1)$$

$$NII_{it} = \beta_0 + \beta_1 NIM_{it} + \sum_p \mu_{pit} Y_{pit} + \epsilon_{it}\,, \quad (2)$$

where NIM_{it} is net interest margin of bank i in year t, NII_{it} is the share of non-interest income, X_{kit}'s and Y_{pit}'s are other control variables that are expected to affect net interest margin and the degree of diversification, respectively, and u_{it} and ϵ_{it} are the error terms with standard properties. Net interest margin (NIM) is calculated by net interest income divided by the average of earning assets at the end of previous and current periods. Since NIM stems mainly from deposits and loans, it is a conventional measure for the traditional banking activities. The share of non-interest income (NII) is measured by non-interest income divided by the sum of net interest income and non-interest income. As mentioned in many studies, including Nguyen (2012); Lepetit, Nys, Rous, & Tarazi (2008); Rogers & Sinkey Jr. (1999), NII can be a measure for non-traditional

banking activities, since it represents the degree of diversification toward non-traditional or non-interest income activities[5].

Table 3 : Definition of variables used to estimate in the model

1	NIM	Net Interest income / Average Earning Assets
2	LACSTF	Liquid Assets / short-term funding
3	LLRGL	Loan Loss Reserve / Total Gross Loan
4	COV	LACSTF * LLRGL (Risk Interaction)
5	BANKS	Each bank Deposit / Total Deposit
6	NIEAA	Non-interest Expensive / Average gross loan
7	ETA	Total Equity / Total Assets
8	LNTA	Natural logarithm of Total Assets
9	NLTA	Net Loan / Total Assets
10	OVTA	Overhead cost / Average total assets
11	NII	Non-interest income / (Interest income – interest expense + non-interest income)

Note: Average value is calculated by the average of variables at the end of current and previous period.

Table 3 shows the definitions of all variables used to estimate the empirical models. Concerning the interest margin equation (1), some theoretical studies suggest that interest margin is related to some bank-specific characteristics, such as operating costs, the degree of risk aversion, interest rate risk, credit risk, covariance of interest rate risk and credit risk, the bank size, capital adequacy ratio, and non-interest income (see, e.g., Ho and Saunders, 1981; Zarruk and Madura, 1992; Angbazo, 1997; Wong, 1997; Maudos and Guevara, 2004; Valverde and Fernandez, 2007; Nguyen, 2012). As control variables in equation (1), we include the ratio of liquid assets to short-term funding (LASFT) and the ratio of loan loss reserves to gross loans (LLRGL) as proxies for

[5] Some studies such as Nguyen (2012) uses the ratio of other earning assets to total assets as a measure of the degree of diversification or the non-interest income activities, following the discussion in Clark and Siems (2002) and Valverde and Fernandez (2007). Non-interest income as a measure commonly used to proxy for non-traditional off-balance sheet activities in many studies may exaggerate such activities since some parts of fees and commissions stem from on-balance-sheet activities. In addition, the revenue-based measure often fails to capture the real situation. However, since the Cambodian banking industry is still at the mature stage in terms of non-interest income activities, we believe that our measure could be appropriate enough to analyze the issues in Cambodia.

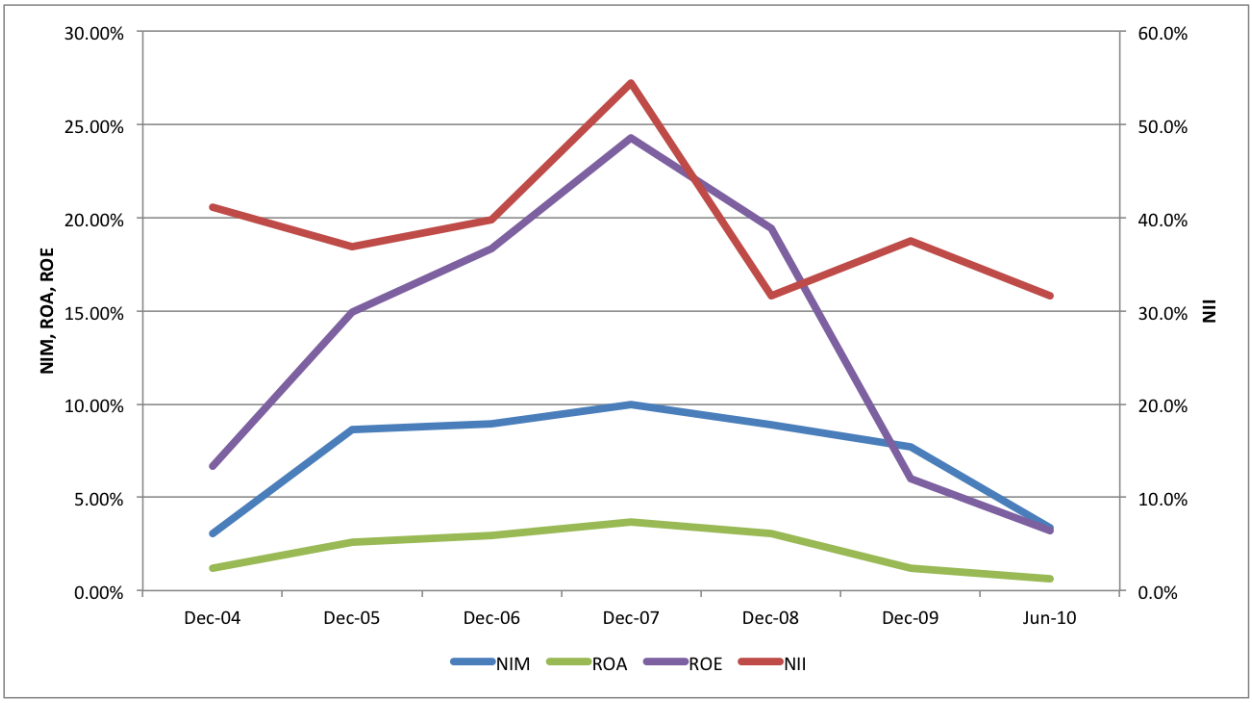
inverse interest rate risk and credit risk, respectively. The product of LASFT and LLRGL (COV) is also included to capture the interaction of interest rate risk and credit risk. The model also captures the bank size, the market share, the capital ratio, the loan-deposit ratio, and the operating cost efficiency by including the log of total assets (LNTA), the share of total deposits within the banking system (BANKS), the ratio of equity to total assets (ETA), and the ratio of non-interest expense to the average of total assets at the end of previous and current periods (NIEAA), respectively.

Concerning the diversification equation (2), many works also suggest that non-interest income activities depend on several bank-level characteristics, such as bank size, credit risk, and interest rate risk (see, e.g., Diamond, 1984; Hunter and Stephen,1986; James, 1988; Demsetz and Strahan, 1997; Angbazo, 1997; Davis, 2002; DeYoung and Rice, 2004; Valverde and Fernandez, 2007; Nguyen, 2012). In this study, LASFT, LLRGL, and COV are included as the control variables to capture inverse interest rate risk, credit risk, and their risk interaction, respectively. In addition, we include the log of total assets (LNTA), the ratio of net loans to total assets (NLTA), the ratio of overhead costs to the average of total assets at the end of previous and current periods (OVTA), and the ratio of profit before tax to the average of total assets at the end of previous and current periods (PBTTA) to control the bank size, the asset structure, the operating expense, and profitability, respectively. Similar to the interest margin equation (1), we also include the dummy variable (DC), which differentiate the specialized and commercial banks.

For the better understanding of the relationship between NIM and NII, we divide the whole sample period (2004Q4 to 2010Q2) into two sub-sample periods, 2004Q4 to 2007Q2 and 2007Q3 to 2010Q2. One important reason for this division is that although the negative impact was less significant compared with other Asian countries, the Cambodian banking industry was influenced by the global financial crisis in the mid of 2007, associated with the threat of collapse of financial institutions and downturns in stock markets around the world. In fact, the trends of return on assets and the share of non-interest income have changed from upwards to downwards at the peak in 2007 (see Figure 3). Based on the Cambodia Rehabilitation and Development Board, Council for the Development of Cambodia & Ministry of Economy and Finance (December, 2008), there is an indirect impact of global financial crisis on Cambodia in 2007 which affects Cambodian economy on many sectors involving trade with western countries.

Hence, the year of 2007 should be the flexible point of the Cambodian economy including financial sector.

Figure 1 : Evolution of NIM, ROA, ROE and NII



3.2 Some preliminaries

Tables 3 presents the summary of statistics and the pairwise correlations of variables used in our empirical analysis for full sample period, and each of the sub-sample periods. The average of net interest margin (NIM) during the first sub-sample period (2004Q4 to 2007Q2) is lower than that during the second sub-sample period (2007Q3 to 2010Q2), while the average of the share of non-interest income (NII) during the first sub-sample period is slightly higher than that during the second sub-sample period (Table 4). Concerning the relationship between traditional and non-traditional banking activities over the two sub-sample periods, Table 5 shows that the correlation of NIM and NII is negative during the first sub-sample period, while that of NIM and NII is positive during the second sub-sample period.

To check this structural change in our sample, we apply the nonparametric tests, as examined in Calmès and Théoret (2010). Table 5 displays the results of pairwise correlation, the Spearman's rank correlation, and the Kendall's tau rank-order correlation of NIM and NII. The three tests show the similar results, as expected. During the first sub-sample period, the pairwise correlation between NIM and NII is significantly negative, and the results of Spearman’s and Kendall’s tests

shows the significantly negative correlation between NIM andNII. In contrast, during the second sab-sample period, the pairwise correlation between NIM and NII is significantly positive, although the other two tests show less clear results about the correlation between NIM and NII. These results could provide a possible justification that the global financial crisis in 2007 might influence the profit structure in the Cambodian banking industry. In fact, many reports related to the discussion among cross-ministries have addressed the crisis issues, and many Cambodian economists reported that the Cambodian economy has experienced the slowdown since 2007. The first sub-sample period corresponds to the growing period and the second sub-sample period to the less-growing period.

Table 4 : Variable descriptive statistic

Full Sample

Variable	Obs	Mean	Std. dev.	Min	Max
NIM	418	0.02695	0.02918	-0.00191	0.49059
NII	418	0.38244	0.21118	0.00358	1.20161
LACSTF	418	25.94712	405.06150	0.05086	8143.22800
LLRGL	418	0.03519	0.04933	-	0.26966
COV	418	0.66831	11.94294	-	243.74040
BANKS	418	0.05229	0.06269	-	0.27020
NIEAA	418	0.03577	0.17650	0.00039	2.92455
ETA	418	0.32008	0.23375	0.03860	1.01617
LNTA	418	18.05614	1.25896	15.13989	20.78272
NLTA	418	0.52633	0.19240	0.00383	0.90310
OVTA	418	0.03577	0.17650	0.00039	2.92455

First Period Sample

Variable	Obs	Mean	Std. dev.	Min	Max
NIM	165	0.02386	0.01851	-0.00191	0.09784
NII	165	0.41318	0.21590	0.09166	1.20161
LACSTF	165	1.08286	2.19684	0.05639	19.25007
LLRGL	165	0.05606	0.06491	-	0.26966
COV	165	0.08811	0.28734	-	2.78951
BANKS	165	0.06001	0.06653	0.00004	0.27020
NIEAA	165	0.02373	0.10204	0.00039	1.29689

ETA	165	0.30485	0.22481	0.07527	0.93197
LNTA	165	17.81114	1.13099	15.13989	19.74323
NLTA	165	0.51628	0.19613	0.09816	0.84337
OVTA	165	0.02373	0.10204	0.00039	1.29689

Second Period Sample

Variable	Obs	Mean	Std. dev.	Min	Max
NIM	253	0.02897	0.03429	0.00197	0.49059
NII	253	0.36239	0.20602	0.00358	0.94674
LACSTF	253	42.16294	520.41600	0.05086	8143.22800
LLRGL	253	0.02158	0.02852	-	0.18356
COV	253	1.04671	15.34950	-	243.74040
BANKS	253	0.04725	0.05965	-	0.20842
NIEAA	253	0.04362	0.21123	0.00105	2.92455
ETA	253	0.33000	0.23932	0.03860	1.01617
LNTA	253	18.21592	1.31353	15.31713	20.78272
NLTA	253	0.53289	0.19003	0.00383	0.90310
OVTA	253	0.04362	0.21123	0.00105	2.92455

Table 5 : The order correlation of NIM and NII

Period	Pairwise Correlation Coefficient	P-value	Obs
2004Q4-2007Q2	-0.3426	0.0000	165
2007Q3-2010Q2	0.1867	0.0029	253
Period	Spearman's rho	P-value	Obs
2004Q4-2007Q2	-0.3373	0.0000	165
2007Q3-2010Q2	0.0350	0.5798	253
Period	Kendall's tau	P-value	Obs
2004Q4-2007Q2	-0.2311	0.0000	165
2007Q3-2010Q2	0.0267	0.5270	253

3.3 Results

This subsection shows the estimated results over each of the two sub-sample periods. If these two equations are estimated separately, the estimators would suffer from bias and inconsistent problems due to the correlation among the error terms and the endogeneity problem. To mitigate

such issues, we estimate simultaneous equations (1) and (2) jointly by applying the three-stage least square (3SLS) method, which treats NIM and NII as endogenous variables. The model assumes both of them are correlated with the disturbances in the system equations, while it uses all independent variables as exogenous variables (Zellner and Theil, 1962). Table 11 shows the estimated results of the simultaneous equations. The model specifications would be satisfactory due to the large p-value of the Hansen (1982)'s J tests, which identify the validity of the instruments.

Table 6 : The model result

Dependent Variable: Net Interest Margin (NIM) Coefficients on: (Standard errors)				
	Without Time Dummy		With Time Dummy	
Variable	Period 1 2004:Q4-2007:Q2	Period 2 2007:Q3-2010:Q2	Period 1 2004:Q4-2007:Q2	Period 2 2007:Q3-2010:Q2
NII	-0.0303**	0.1356***	-0.0301***	0.1242***
	(0.0121)	(0.0242)	(0.0086)	(0.0234)
LACSTF	-0.0014	0.0000	-0.0008	0.0000
	(0.0019)	0.0000	(0.0014)	0.0000
LLRGL	-0.0005	-0.5057***	0.0307*	-0.4687***
	(0.0256)	(0.1035)	(0.0186)	(0.1013)
COV	0.0183	-0.0002	0.0147	-0.0010
	(0.0133)	(0.0009)	(0.0095)	(0.0009)
BANKS	-0.0564	0.3770***	-0.0775**	0.2515***
	(0.0425)	(0.0838)	(0.0315)	(0.0880)
NIEAA	0.0461***	-0.0006	0.0381***	-0.0049
	(0.0134)	(0.0117)	(0.0097)	(0.0111)
ETA	0.0126	0.0217	0.0221**	0.0540***
	(0.0133)	(0.0162)	(0.0103)	(0.0185)
LNTA	0.0064	-0.0175***	0.0096***	-0.0075
	(0.0051)	(0.0048)	(0.0037)	(0.0056)
Dependent Variable: Non-Interest Income (NII)				

	Coefficients on: (Standard errors)			
NIM	-12.9792*	0.3670	-9.6104**	0.1660
	(6.8556)	(0.8593)	(3.4975)	(0.9021)
LACSTF	-0.0412	-0.0001	-0.0325*	-0.0001
	(0.0274)	(0.0001)	(0.0188)	(0.0001)
LLRGL	-0.3435	2.1566***	-0.0991	2.2117***
	(0.3635)	(0.3876)	(0.2707)	(0.3743)
COV	0.2739	0.0023	0.1886	0.0033
	(0.2305)	(0.0039)	(0.1476)	(0.0039)
LNTA	-0.0288	0.0057	-0.0334*	0.0043
	(0.0296)	(0.0086)	(0.0199)	(0.0086)
NLTA	-0.3824***	-0.5593***	-0.4431***	-0.5677***
	(0.1698)	(0.0625)	(0.1096)	(0.0614)
OVTA	0.8830***	0.2387***	0.6940***	0.2406***
	(0.3064)	(0.0539)	(0.1686)	(0.0516)
Hansen-Sargan statistic	0.5520	0.8020	1.3030	0.056
J-stat (P-value)	0.4576	0.3703	0.2536	0.8123

Note: *** significance level of 1 %; ** significance level of 5 %; * significance level of 10 %

Result from the estimation

Table 6 reports the regression result for Eq. (1) and Eq. (2) using the system estimation. Firstly, our results contain 2 periods which using the correlation test that report in table 5. The first period starts from end of 2004 to mid of 2007, and second period contains from mid of 2007 to mid of 2010. The models have structure break of these sample for the reasons describe in the previous section. The models have included the valid instrument because the model specifications are satisfactory based on large p-value (greater than 10% significant) from the Hansen's J tests so that we reject the null hypothesis of weak instrument variables. The model's result appears with 2 different cases. The first estimation has no time dummy and the second estimation includes time-dummy. Both estimation results are consistent; however, there are some variables have significant when the model input the time-dummy.

The result of non-interest income and interest income:

The regression without time dummy and with time-dummy result shows that NII is negatively significant at 5 % and 1% respectively with NIM for first period. The first period result reveals that the NII has negative effect on NIM. Thus, if the non-interest income increases by 1 %, the net interest margin decreases around 0.03%. This result reflects the unbeneficial of non-interest income on net interest margin. Supporting the loss-leader hypothesis in banking, the bank interest margin is lower because of the increasing in non-interest incomes (Nguyen, 2012). Therefore, we can infer from the first period that there might be higher bank loan pricing, which increases non-traditional activities. This finding also shares the same result with Carbó Valverde & Rodríguez Fernández (2007) who study the determinant of bank margins in European banking. For the second period, however, the both estimation results also reports that NII has positively significance at 1% with NIM. Around 0.12% to 0.13% of net interest margin can be benefit from the 1% increase of non-interest income. We can infer from this result that the increase of nontraditional activities rises along with net interest margin. This result can imply that in the less-growing period Cambodian banks might face the falling of the profit, which results from falling from both interest income and non-interest income, while it cannot prevent the external shock from the crisis. However, this result is different from many previous researches about bank profit in developed countries.

From result of equation (2), the NIM has negative effect on non-interest income only in the first period. Without time dummy, the increase in NIM 1% can reduce the NII around 13% and with time-dummy NII decrease around 9%. It is understood that bank margin and NII have trade-off result contribution to the total profit. For example, if banks want to increase non-interest income, banks face the decision in lowering the bank margin and vice versa. Anyway, in the second period, the sign is positive but insignificant. It reflects that the increase in bank margin has to lower the NII.

From both equations, we note that the decrease of NII in equation 2 is larger than that NIM in the equation 1. The increase in NIM 1% will reduce the NII around 9-13% while NII increase 1 % reduce the NIM only 0.03%. Therefore, the causal effect of NIM on NII is more sensitive compared with NII on NIM. To sum up, the increase of bank margin share does not share any benefits to non-interest income. And the introduction of the non-interest income might not have reduced much on bank margin.

The result of control variables:

Another coefficient on the adverse interest rate risk, LACSTF, is positive insignificantly in the first period. It implies that banks margin is independent from interest risk in those periods. The variable COV, the product of inverse credit risk and interest rate risk, is found to be no relationship with NIM and NII. The result of the equations 1 reports that the coefficient on proxy for credit risk, LLRGL, is positively significant at 5% for first periods using time-dummy. This result is consistent with Brock & Rojas Suarez (2000); Heffernana & Fu (2010); Maudos & Fernández de Guevara (2004); Wong (1997). Heffernana & Fu (2010) find this relationship as positive for Chinese banks. Maudos & Fernández de Guevara (2004); Wong (1997) propose that banks have higher credit risk followed by higher NIM. The reason is that banks, which have higher LLRGL or higher bad loan, have made adequate provision. However previous study, Brock & Rojas Suarez (2000) find that credit risk reduce the spread in many Latin American countries, but their result inverses for Columbia. In short, this relationship can imply that high risk works with high return.

In the equation (1), the coefficient of BANKS explains 1% negative effect on NIM in the first period. It suggests that higher market share will lower the net interest margin around 0.077%. The sign becomes positive effect in the second period. And the coefficient is higher than in the first period, and it suggest that the bank with higher market share tends to increase NIM around 0.2515% in the model with time-dummy. One research explains that the higher market share reflects competent banks (Berger, 1995a). In other words, poor capitalized banks tend to lower the margin to increase the market share (Brock & Rojas Suarez, 2000). The coefficient of NIEAA has positive effect on NIM in the first period, but insignificant in the second period. This positive effect implies that banks have high margin need higher operating cost. Brock & Rojas Suarez (2000) also conclude that operating cost push bank spread. However, it is not a surprising result that higher cost increases the profit. The variable ETA has positive effect on NIM for both periods when including time-dummy. This positive sign imply that when banks become more risks averse, banks tend to increase their interest margin. This result is consistent with Nguyen (2012) and Berger (1995). Berger (1995) finds that higher capital ratio increases firms' return and Nguyen (2012). But, this result differs from Wong (1997) who found that the banks' higher equity lower the spread. The bank size is common to measure the bank interest margin. LNTA is positively significant at 1 % in the first period when we include time-dummy. It reflects that the larger banks tend to have higher margin, so the prudential aspect for Cambodian authorities is "too big to fail". Anyway, it is negative insignificant in the second period. However, the sign

becomes negative significantly at 1% in the second period when we exclude the time-dummy. A possible explanation for this phenomenon refers to previous section, which describes the story of the period, has been divided; hence, the larger banks have lowered their interest margin from the evident that this period banks profit decreases.

The simulation result from equation (2), table 6, reports that LACSTF and COV are not significant effect on NII for both periods; thus, there is no relationship between interest rate risk and non-interest income. The coefficient of LLRGL has found no significant on NII in the first period. But it has a statistically significant positive effect at 1% for the second periods on NII. This result reveals that the increase of loan loss provision will serve as compensation for the increase in income. The coefficient of LNTA has slightly negative effect on NII at 10% only in the first period when we include time-dummy. The suitable explanation is that Cambodian banks which have larger assets tend to reduce non-interest income. The variable, NLTA is the size of bank loan to market, has negative effect on non-interest income for both periods. It is suggested that the more loan approved the lower non-traditional activities. Since the number of loan disbursement out has increased banks customers, but this situation might happen because of many Cambodian banks do not concentrate on non-interest income so much, so most of banks focus on traditional activities. The coefficient of OVTA has positive effect for both periods. It implies that operational inefficiency associates positively with non-interest income. It is obvious that the higher overhead cost has to compensate by the non-interest income.

To sum up, the control variables show the consistency with previous researches. The interesting point is that interest rate risk does not associate with interest and non-interest income for the Cambodian banks. On the other hand, credit risk seem not related with NIM and NII in the growing period, but in the less-growing period, credit has positive effect on NII while it is negative with NIM. This phenomenon implies that NII and NIM has different nature and both factors have share contrasting sign on each other even in any circumstance. In short, there exist the negative relationship between NII and NIM in the growing period, but in the less-growing period most of Cambodian banks can benefit from utilizing the non-interest incomes.

3. CONCLUSION

This study has examined the simultaneous relationship between interest margin and non-interest income. Overall, this study provides the evidences of the association between the decrease in Cambodian banks interest margins and increase in non-interest income. Following the situation of the competitive which might lower the interest margin itself has been ignored; it suggests that Cambodian banks reallocate their interest revenue to non-interest income by focusing on bank non-traditional activities. It shows the trade-off in optimizing the bank profit in the competitive market. However, during the second period or the less-growing period, the net interest margin would increase if non-interest income keeps the same increasing as the previous period. This positive relationship indicates that the Cambodian banks have more incentive to implement non-traditional banking activities in the less-growing period rather than in the growing period. In other word, the banks might have more profitability by increasing the non-traditional activities in the depression period.

This paper also finds that the increase in interest margin lowers the non-interest income in the normal growth economy, but the result reverses in the less-growing period. It comes up with arguing that non-traditional activities have a negative relationship with traditional activities for the Cambodian banking system during the normal economic growth. In this case, banks may optimize their income by balancing these activities. However, in the less-growing period, the banks might need to put more weight on non-traditional activities because it will be better to diversify bank revenue. In addition, banks might suffer from credit risk impact while they seek to get higher credit risk from traditional activities in the less-growing period.

The important note of this paper is to utilize the concept of the structure of banks profit. Hence, our results have shared some policy implications to policy makers for their future reference such as bank supervision from the perspective of analyzing bank risk and profit. The first argument is that both interest and non-interest incomes have many different aspects in term of credit risk and bank size. Thus, the policy makers might need to pay attention to this perspective. Second, the banks face the trade-off between interest margin and non-interest income during the regular situation. Thus, this negative relationship reveals the clues for the supervisor and policy makers to distinguish these two factors and to identify the source and profitability of each bank. It also gets the attention of the bank examiners carefully focusing not only on credit, but also on the off-balance sheet activities and fee service incomes. Last, it is obvious that in the less-growing

period, policy makers might need to respond with careful observe with the source of the bank's income because some banks might suffer a lot of their transactions concentration.

However, our research has some limitations. First of all, it cannot capture the time variance of the situation. Therefore, further research may need to extend our research based on the new models which using time different method. Second, the limitation of data, so it might also included new available data recently. Last of all, relationship of both non-interest income and bank margin may change due to the economic situation, so it is better to include some macroeconomic indicators and checking robustness by using other fixed effect model.

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